**GUIDANCE DOCUMENT**
*LTO-001*
*Shasta Cold Water Pool Management*
*LTO Implementation*
*October 18, 2021*

## I. PURPOSE

This document provides implementation guidance on the Shasta Reservoir's Cold Water Pool (CWP) Management pursuant to Section 4.10.1.4 of the U.S. Bureau of Reclamation's (Reclamation) and the California Department of Water Resources (DWR) Proposed Action and NOAA's National Marine Fisheries Service's (NMFS) Biological Opinion and Incidental Take Statement (ITS). The scope of guidance includes the deliverables, schedule, and processes of different teams to implement operations for CWP Management. The primary deliverables are Sacramento River Temperature Task Group (SRTTG) notes, a monthly summary of the hydrologic, operational, and temperature data related to cold water pool management; a Temperature Management Plan (TMP), and documentation of the operations decisions including any recommendations from Upper Sacramento Scheduling Team (USST). Reclamation will manage requirements of the California State Water Resources Control Board (SWRCB) Decision 90-5 separately.

## II. Cold Water Pool Management

This section provides the applicable verbatim language for Cold Water Pool Management.

**Proposed Action:**

### *4.10.1.4 Cold Water Pool Management*

The closer Shasta Reservoir is to full by the end of May, the greater the likelihood of being able to meet the Winter Run Chinook Salmon temperature targets throughout the entire temperature control season. If Shasta Reservoir storage is high enough to use the Shasta TCD upper shutters by the end of May, Reclamation can maximize the cold water pool potential. Storage of 3.66 MAF allows water to pass through the upper gates of the Shasta TCD, but historical relationships suggest that a storage of 4 MAF on May 1st generally provides enough storage to continue operating through the upper gates and develop a sufficient cold water pool to meet 53.5°F on the Sacramento River above Clear Creek (at the CCR gaging station) for Winter-Run Chinook Salmon spawning and egg incubation with minimal risks of higher temperatures in the late summer and fall. Figure 4-2 provides an approximate estimate of the relationship between temperature compliance, total storage in Shasta Reservoir, and cold water pool in Shasta Reservoir.

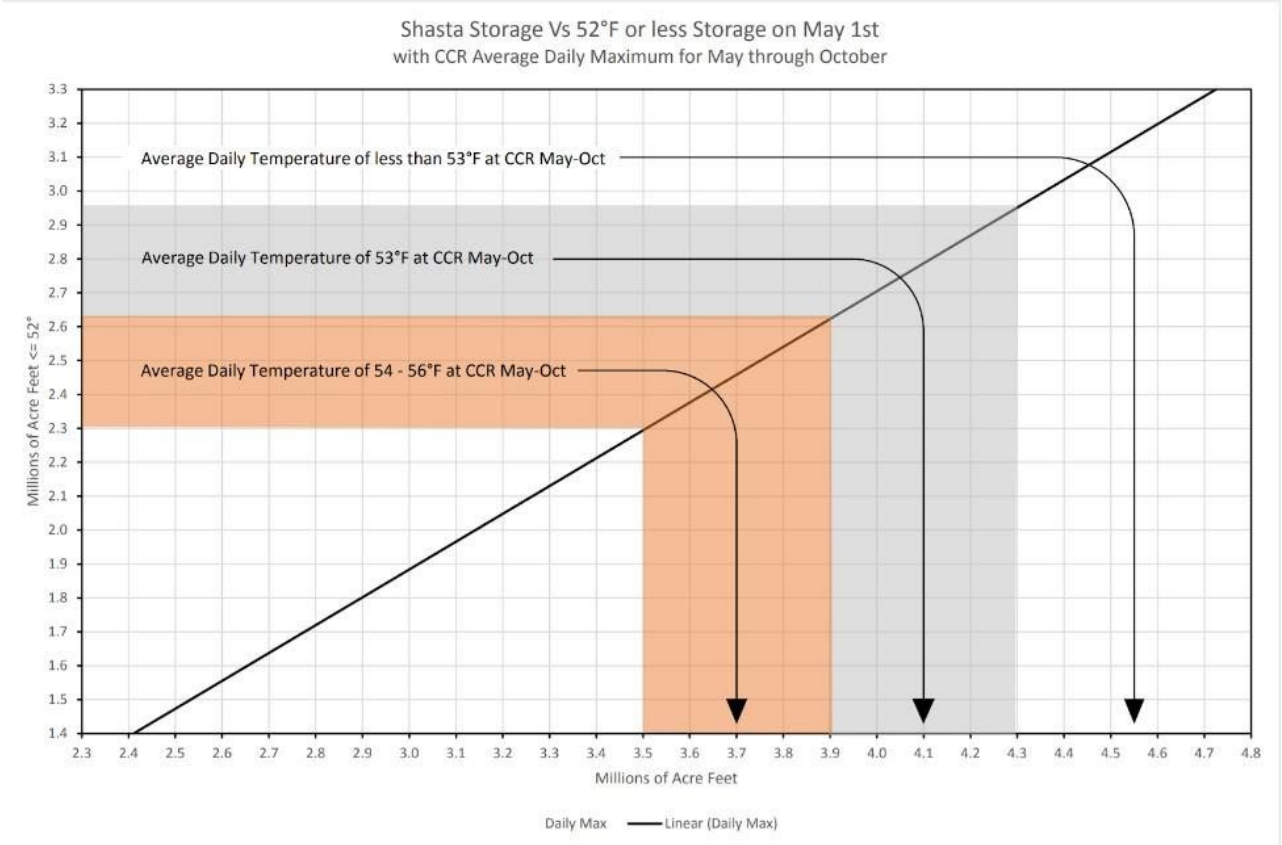


**Figure 4-2. Relationship between Temperature Compliance, Total Storage in Shasta Reservoir, and Cold Water Pool in Shasta Reservoir**

## Summer Cold Water Pool Management

Reclamation proposes to operate the TCD at Shasta Dam to continue providing temperature management in accordance with CVPIA 3406(b)(6) while minimizing impacts on power generation. Cold water pool is defined as the volume of water in Shasta Reservoir that is less than 52°F, which Reclamation would determine based on monthly (or more frequent) reservoir temperature profiles. The Sacramento River above Clear Creek (CCR) gage is a surrogate for the downstream extent of most Winter-Run Chinook Salmon redds. Temperature management would start on May 15, or when the SRTTG determines, based on real-time information, that Winter-Run Chinook Salmon have spawned, whichever is later. Temperature management would end October 31, or when the SRTTG determines based on real-time monitoring that 95 percent of Winter-Run Chinook Salmon eggs have hatched, and alevin have emerged, whichever is earlier. Real-time information will continue to be considered in this process, which includes redd, carcass, and juvenile surveys.

Reclamation proposes to address cold water management utilizing a tiered strategy that allows for strategically selected temperature objectives, based on projected total storage and cold water pool, meteorology, Delta conditions, and habitat suitability for incoming fish population size and location. The tiered strategy recognizes that cold water is a scarce resource that can be managed to achieve desired water temperatures for fisheries objectives. Figure 4-3 below shows examples of water temperatures at CCR under the four tiers, with arrows indicating how temperatures would change in different years with less May 1 forecasted cold water pool. The proposed tiers

are described below, along with storage levels that are likely to provide for cold water management within the tier. Actual operations will depend upon the available cold water and modeling. In any given year, cold water pool and storage could result in Reclamation switching between tiers within the year if needed to optimally use the cold water pool. Coldwater pool management is proposed to start as early as May 15th, however temperatures at the start of the temperature management season are often lower than the target temperatures.

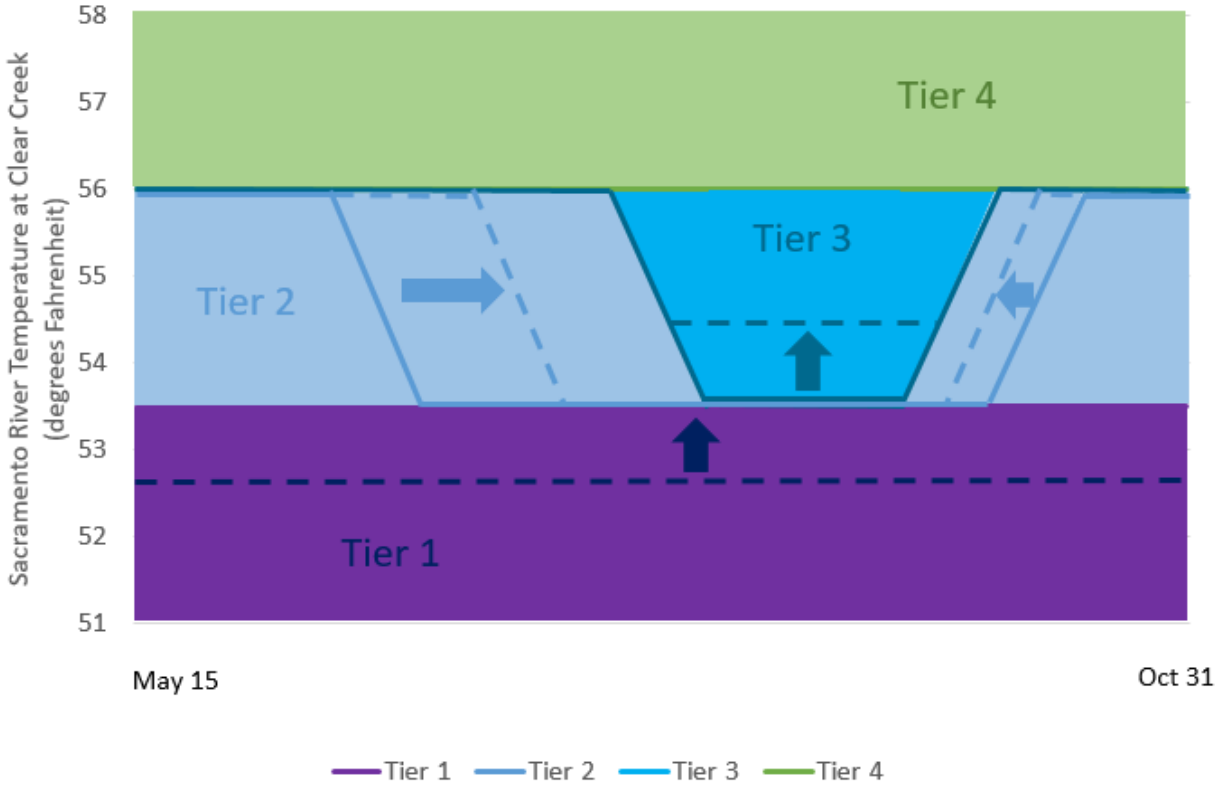


**Figure 4-3. Tiered Temperature Management Strategy**

- **Tier 1**. In years when Reclamation determines that cold water pool is sufficient (e.g., more than 2.8 MAF of cold water pool in Shasta Reservoir at the beginning of May or modeling suggests that a daily average temperature of 53.5°F at CCR can be maintained from May 15 to October 31), Reclamation proposes to operate to a daily average temperature of 53.5°F at the CCR gaging station to minimize temperature dependent mortality. Although Tier 1 years generally have sufficient cold water to maintain 53.5°F through October 31, the unknown meteorology continues to present a risk of temperatures rising above 53.5°F, particularly towards the end of the summer in September and October. Reclamation can generally manage these risks through real time operations of the TCD, although temporary exceedances may occur, and thus allowable tolerances will be identified in the annual temperature management plan through coordination with SRTTG.
- **Tier 2.** In years when cold water pool is insufficient to allow Tier 1 (e.g., less than 2.8 MAF of cold water pool in Shasta Reservoir at the beginning of May or modeling suggests that the 53.5°F at CCR cannot be maintained from May 15 to October 31), Reclamation would optimize use of cold water for Winter-Run Chinook Salmon eggs based on life-stage-specific requirements,

reducing the duration of time of operating to 53.5°F target temperatures. Water temperatures at CCR would vary based on real-time monitoring of redd timing and lifestage-specific temperature dependent mortality models, for example, Anderson (2017). The period of temperature management with 53.5°F at CCR would be centered on the projected time when the Winter-Run eggs have the highest dissolved oxygen requirement (37–67 days post fertilization). At 2.79 MAF of cold water pool, Reclamation would operate to 53.5°F from 37 days after the first observed redd to 67 days after the last observed redd, if this is earlier than October 31. The duration of the 53.5°F protection will decrease in proportion to the available cold water pool on May 1. Reclamation will determine this time period by running different temperature scenarios through the latest egg mortality model(s) and real-time monitoring of redds. Reclamation would operate to daily average temperatures at CCR during the temperature management season outside of the stage- specific critical window no warmer than 56°F. Although Tier 2 years generally have sufficient cold water to maintain 56°F after the last observed redd through October 31, the unknown meteorology continues to present a risk of temperatures rising above 56°F, particularly towards the end of the summer in September and October. Reclamation can generally manage these risks through real time operations of the TCD, although temporary exceedances may occur and thus allowable tolerances will be identified in the annual temperature management plan through coordination with the SRTTG.

- **Tier 3.** When Reclamation determines that life-stage-specific temperature targets cannot be met per (2) above (e.g., less than 2.3 MAF of cold water pool in Shasta Reservoir at the beginning of May or modeling suggests that cold water pool management at colder tiers would cause loss of temperature control late in the season), Reclamation proposes to use cold water pool releases to maximize Winter- Run Chinook Salmon redd survival by increasing the coldest water temperature target (see Figure 4-4 below). In Tier 3, the targeted temperature at CCR during the early and late periods of cold water pool management will not exceed a daily average of 56°F. Based on latest egg mortality models, real-time monitoring, and expected and current cold water availability, Reclamation would decrease the temperatures during the period of greatest temperature stress on early life stages to minimize adverse effects to the greatest extent possible. During this critical period, temperatures will be targeted between 53.5°F and 56°F. Tier 3 will be selected if Reclamation's temperature management plan indicates that temperatures can be maintained to at least 56°F at CCR, otherwise Reclamation would operate to Tier 4. Although Tier 3 years generally have sufficient cold water to maintain 56°F through October 31, the unknown meteorology continues to present a risk of temperatures rising above 56°F, particularly towards the end of the summer in September and October. Reclamation can generally manage these risks through real time operations of the TCD, although temporary exceedances may occur, and thus allowable tolerances will be identified in the annual temperature management plan through coordination with the SRTTG. If the temperature management plan indicates a higher risk of exceeding 56°F before October 1st, this is an indication that the cold water pool may not support a warm early fall and will therefore be treated as a Tier 4 year for the purposes of intervention measures and early season discussions and coordination.
- **Tier 4.** If there is less than 2.5 MAF of total storage (note the use of "total" storage as opposed to the "cold water pool" used in the previous criteria) in Shasta Reservoir at the beginning of May, or if Reclamation cannot meet 56°F at CCR, Reclamation will attempt to operate to a less than optimal temperature target and period that is determined in real-time with technical assistance from NMFS and USFWS. Reclamation will explore improved coordination of downstream diversions, and the potential for demand shifting. In addition, Reclamation proposes to implement intervention measures (e.g., increasing hatchery intake and trap and haul, as described below).

At the March forecast (mid-March), if the forecasted Shasta Reservoir total storage is projected to be below 2.5 MAF at the beginning of May, Reclamation would initiate discussions with

USFWS and NMFS on potential intervention measures should this low storage condition continue into April and May, as described in Tier 4. Reclamation proposes to perform the first temperature model run in April after the DWR Bulletin 120 has been received and the operations forecast completed and would provide this forecast to USFWS and NMFS if it is projected to be a Tier 4 year. This is the first month that a temperature model run is feasible based on temperature profiles. Prior to April, there is insufficient stratification in Shasta Reservoir to allow a temperature model to provide meaningful results. The April temperature model scenario is used to develop an initial temperature plan for submittal to the SWRCB. This temperature plan may be updated as Reclamation has improved data on reservoir storage and cold water pool via the reservoir profiles at the end of May, and throughout the temperature control season. Figure 4-4 provides a decision tree explaining the decision points for Shasta Reservoir temperature management.

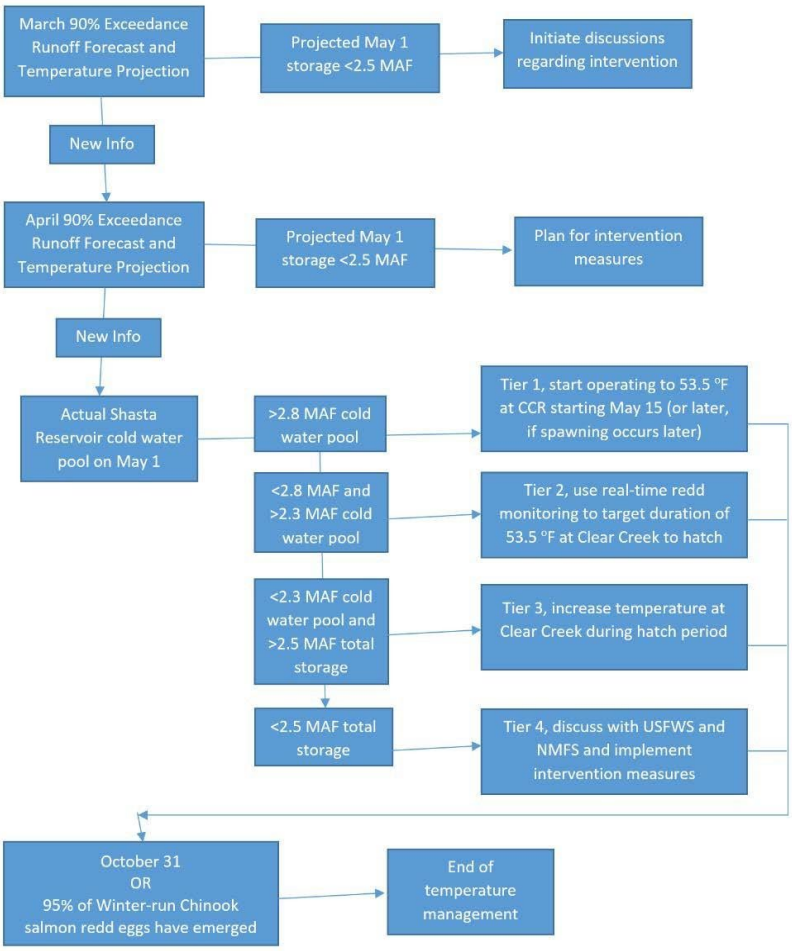


**Figure 4-4. Decision Tree for Shasta Reservoir Temperature Management**

Reclamation intends to collect temperature profile measurements for Shasta, Whiskeytown, and Trinity Reservoirs on the schedule shown in Table 4-9 and provide these to USFWS and NMFS if it is projected to be a Tier 4 year.

**Table 4-9. Temperature Profile Measurements for Shasta, Whiskeytown, and Trinity Reservoirs**

| Reservoir | Every Month | Every 2 Weeks | Every Week | Comment |
|---|---|---|---|---|
| Shasta | 01/01–03/01<br>12/1–12/31 | 03/01–05/01<br>11/15–12/01 | 05/01–11/15 | 25 ft intervals for "Every Month," otherwise 5 ft intervals |
| Whiskeytown | 01/01–12/31 | | | 25 ft intervals |
| Trinity | 01/01–12/31 | | | 25 ft intervals |

Reclamation proposes to provide a draft temperature management plan to the SRTTG in April for its review and comment, consistent with WRO 90-5. The draft temperature management plan will describe which of the four tiers Reclamation forecasts for that year's summer temperature management season, along with a temperature modeling scenario and the operations forecast. The scenario shall include projected reservoir releases, assumed meteorological conditions, and anticipated water temperatures and target locations for the planned water temperature targets. For the final temperature management plan, Reclamation will use conservative assumptions for determining the Shasta Cold Water Management Plan including relying on the actual May 1st storage, a conservative inflow forecast for inflow May through September, proposed releases based on a conservative forecast and a conservative historical meteorology. Reclamation will utilize a forecast with 90% exceedance in the aggregate (when jointly considering multiple significant known uncertainties such as hydrology and meteorology) to develop conservative water temperature forecasts, although certain circumstances may lead Reclamation to use different exceedance levels to incorporate an appropriately more conservative approach. Reclamation shall share forecast assumptions with NMFS through the SRTTG. Reclamation anticipates NMFS will provide technical assistance through the SRTTG.

Consistent with the Shasta Cold Water Management Plan, Reclamation shall operate the Temperature Control Device at Shasta Dam to manage water temperatures below Keswick Dam and monitor the results. If monitored water temperatures exceed the target temperature (with allowable tolerances) in the Shasta Cold Water Management Plan for longer than 3 consecutive days, Reclamation shall notify NMFS of what actions, if any, are being taken to address the exceedances and will arrange for a follow-up on day 5 if the actions do not resolve the issue.

### Commitment to Cold Water Management Tiers

The temperature tier will be forecasted in April of each water year based on forecasted cold water pool volume and temperature modeling results indicating the feasibility of meeting a particular tier. This tier will be finalized in May when there is additional confidence in the hydrologic forecast. If, as the water year progresses, it is determined that additional cold water is available for temperature control purposes, then the tier may be upgraded to a more beneficial tier. Given the use of conservative forecasts, additional cold water pool would be expected more frequently than less cold water pool, although this would only lead to a change in tiers when the conditions are close to the tier boundaries. Reasons for a mid-season change in tier include (but are not necessarily limited to) changes in hydrology, unusual climate conditions that vary from the climate assumptions in the temperature model, changes in water service delivery patterns and changes in assumptions on water needs for regulatory requirement. Temporary exceedances of target temperatures that are within the allowable tolerances identified in the temperature management plan will not be considered a shift into a different tier. In many cases, these can be corrected with real-time operational adjustments and do not indicate a deficit in cold water pool that

would lead to a warmer temperature target. Reclamation will operate to the most protective temperature tier that is achievable.

Once the initial tier is selected by May 15th, Reclamation will not cause a shift into a warmer tier during real-time implementation of the Shasta Cold Water Management Plan except in the event of responding to emergency and/or unforeseen conditions. Examples of emergency and/or unforeseen conditions, may include, but are not limited to, higher water quality control plan compliance requirements, warmer meteorology, changes in forecasted inflow quantities and temperatures to Shasta, facility malfunctions, and higher than expected non-project water diversions (e.g., diverters other than those exercising water service and repayment contracts with Reclamation such as in-Delta diversions, riparian diversions, etc.).

Reclamation intends to check the temperature management plan (and associated tier) at least monthly and will notify NMFS within 2 business days of determining a potential change to the plan or tier is necessary. Reclamation may be able to adjust operations to overcome unexpected events without changing to a lower tier. Should Reclamation be unable to remain within the same or cooler tier identified by the Shasta Cold Water Management Plan, and require a mid-season change in tier, Reclamation will coordinate with NMFS on the need to charter an independent panel, at the end of the temperature management season, consistent "Chartering of Independent Panels" under the "Governance" section of this Proposed Action. The purpose of the independent review will be to evaluate the conditions experienced during the years under review, the success of the implementation of the tiered strategy, the effect of the implementation on the species, and, if needed, to develop recommendations to improve implementation and performance.

### Upper Sacramento Performance Metrics

Reclamation proposes performance objectives for assessing cold water management under the different tiers. The objective is to ensure that the performance falls within the modeled range and shows a tendency towards performing at least as well as the distribution produced by the simulation modeling of the Proposed Action. Reclamation reviewed the modeled temperature dependent mortality over the CalSimII period of record (1922-2002) with their modeled tier associated with each year. Reclamation's objective, as described in this proposed action, will be to meet the temperature criteria associated with each tier and expects the associated biological performance will fall within the full range of modeled performance. The summary of modeled results is listed below with the median, average, maximum and minimum, and standard deviation values within the years. Reclamation intends for an independent panel to review and refine potential alternative steps if the objectives are not occurring.

Future downstream temperature performance is estimated using a numeric model and assumed future hydrologic, operations, and meteorological conditions. The temperature model makes decisions to select a TCD configuration based on user defined Shasta Dam tail-bay target temperatures. This model representation is more coarse than actual operational flexibility and sometimes does not capture daily adjustments which can be managed in real-time to avoid downstream temperature exceedances. Historical performance compared to model results confirms real-time adjustment capabilities using short-term forecasts and operational adjustments, however, this does not alleviate actual short-term forecast uncertainty. In the spring, simulated storm events will accurately predict unavoidable downstream temperature exceedances due to warm side-flows that dominate the upper Sacramento River system. Summary of modeled temperature dependent mortality:

- Tier 1 – Maximum (39%); Average (6%); Median (2%); Minimum (0.4%); Std. Dev (+/- 9%)
- Tier 2 - Maximum (46%); Average (15%); Median (9%); Minimum (1%); Std. Dev (+/- 16%)
- Tier 3 - Maximum (77%); Average (34%); Median (24%); Minimum (6%); Std. Dev (+/- 31%)
- Tier 4 – Appropriate performance metrics will be addressed under "Drought and Dry Year Actions" consistent with the "Governance" section of this Proposed Action.

Reclamation reviewed the observed egg-to-fry survival over the past 21 years, excluding years with atypical temperature conditions (2015). Reclamation's objective in undertaking habitat restoration and facility improvements, as described in this proposed action, will be to improve the egg to fry survival associated with each tier and expects the associated biological performance to increase over time. The summary of results is listed below with the average, maximum and minimum values within the years analyzed. Reclamation intends for an independent panel to review and refine potential alternative steps if the objectives are not occurring.

Summary of historical egg to fry survival:

- Tier 1 - Average (29%); Maximum (49%); Minimum (15%); Median (28%); Std. Dev (10%)
- Tier 2/3 - Average (21%); Maximum (34%); Minimum (15%); Median (20%); Std. Dev (6%)
- Tier 4 - Appropriate performance metrics will be addressed under "Drought and Dry Year Actions" consistent with the "Governance" section of this Proposed Action.

The 75$^{th}$ percentile values of the historical egg to fry survival will be included as a surrogate for expected improvements in ETF survival for each tier from the habitat restoration projects recently completed, currently underway, or proposed to be completed within the proposed action. These values are: Tier 1 – 32%; and Tiers 2/3 – 27%. These values will be updated with the appropriate metrics once modeled results are available on the expected improvements from these projects.

In the course of developing "Drought and Dry Year" actions, Reclamation and DWR will develop a range of alternative strategies for temperature management. The SRTTG may consider alternative strategies to the approach described in this PA during development of plans for Tier 3 years. In acknowledging that Tier 3 years are expected to produce a range of outcomes that increase the threat of viability to salmonid species, Reclamation will work to limit those effects through the SRTTG. These alternative strategies may be based on new or evolving science on the key biological drivers of temperature dependent mortality. These strategies may require additional analytical methods and monitoring specific to the hydrologic and temperature conditions. Reclamation would evaluate and report upon the effectiveness of strategies. These strategies would be coordinated with the conservation measure that addresses two successive years with total egg-to-fry survival less than 15% in each year.

Reclamation will measure upper Sacramento River fisheries populations, in collaboration with federal, state, and local partners, to estimate the total survival from egg incubation to juvenile migration to Red Bluff Diversion Dam, consistent with the monitoring described in Appendix C. Reclamation will estimate and report on the direct mortality and sublethal effects to egg

incubation associated with water temperatures below Keswick Dam (temperature dependent mortality) using, at a minimum, the Martin et al. (2017) approach unless superseded by mutual agreement with NMFS. Reclamation will report annually on total survival and temperature dependent mortality consistent with Appendix C. The Annual Reporting will include a technical team (e.g., SRTTG) hindcast evaluation of whether either the total egg to fry survival or the temperature dependent mortality exceeded the Tier objective. This evaluation will consider the central tendency of modeled expected survival results and will contribute to determining whether an independent review of the year is required. The annual accomplishments in each year will be compared to the metrics by the review panels in 2024 and 2028, consistent with "Four Year Reviews" under the "Governance" section of this PA, to review whether there is a tendency or trajectory that will not lead to matching or exceeding the distribution of the modeled results over the long-term.

If the actual temperature dependent mortality or egg to fry survival fall outside the range described above in any single year, Reclamation will convene with NMFS to determine if an independent panel is necessary. If a panel is determined necessary, Reclamation will charter an independent panel consistent with "Chartering of Independent Panels" under the "Governance" section of this Proposed Action. If the actual results are within the ranges described above, Reclamation will still convene an independent panel consistent with "Four Year Review" under the "Governance" section of this Proposed Action and described above. The purpose of either panel will be to:

1. Review the drivers behind the management of cold water within the tiers including reservoir storage, releases, meteorology, hydrology, and other conditions affecting building and use of cold water (e.g. emergency, uncertainty, etc.).

2. Review the performance objectives, including the methods for determining temperature dependent mortality and methods for determining total survival.

3. Review the Tier types that have occurred during the performance periods of the Proposed Action and the performance within each tier as compared to expected performance. The selected metrics are the average, median, standard deviation, min, and max of the base dataset. Additional higher-order time series statistics may be used at the request of the review panel. The objective is to ensure that the performance falls within the modeled range and shows a tendency towards performing at least as well as the distribution produced by the simulation modeling of the Proposed Action.

4. Recommend potential modifications to CVP and SWP operations that would improve cold water management that are within the agencies' authorities.

5. Review the effectiveness of habitat restoration, facility improvements, intervention, and research measures.

The panel will prepare a report incorporating discussion of the above items and recommendations, including alternative strategies. NMFS and Reclamation shall meet and confer to discuss the report and any response.

Prior to the initial Four Year Review independent panel, Reclamation shall refine performance objectives for temperature dependent mortality and the total survival of winter-run Chinook salmon from egg incubation to juvenile migration at Red Bluff Diversion Dam. Reclamation expects to participate in an effort by NMFS to establish early life stage survival rates that are required for a positive cohort replacement rate. Reclamation expects NMFS will submit for independent review temperature dependent mortality and egg to fry survival values that, as the species experts and with support from separate analyses, it expects will provide continued support of a viable population. Reclamation expects to participate in the panel and offer technical assistance regarding operations, understanding that these values, or any that result from addressing recommendations from the independent panel, could be adopted with mutual agreement as revised performance metrics for operations.

NMFS ITS:

**RPM 1: Reclamation shall minimize the impact of the amount or extent of incidental take of listed species during operations of the Shasta Division.**

a. In coordination with NMFS and the Sacramento River Temperature Task Group, Reclamation shall consider technical assistance from NMFS regarding the development of annual temperature management plans, regardless of Shasta storage or tiered temperature management stratum. Reclamation shall submit the final temperature management plan to NMFS by May 20 of each year, as reporting under the opinion. NMFS does not expect Reclamation to seek NMFS concurrence on the plan.

b. Reclamation shall not implement the Spring Pulse Flow if the release would cause Reclamation to drop into a lower Tier of the Shasta summer temperature management.

c. […]

d. By February of each year, Reclamation shall provide a hindcast report of temperature-dependent mortality for winter-run Chinook salmon based on realized temperature management. The report shall include:

   - Performance trends to date, observed range of temperature dependent mortality within Tiers, and range of egg-to-fry survival within Tiers,
   - Whether convening an independent panel is appropriate based on performance trends to date, and
   - Response to previous independent panel reviews and/or identification of how comments from previous independent panel(s) are being addressed.

e. In February of each year Reclamation shall create and post a projection of water operations, as described in Appendix C of the biological assessment.

f. […]

## III. DELIVERABLES

Deliverables resulting from temperature management planning efforts follow the coordination described in Appendix C of the Proposed Action, and include the USST notes and SRTTG notes, a determination/recommendation on the onset/end date for temperature management, and documentation of operation decisions. Section IV herein describes the processes to achieve the

deliverables. Agendas are attached that describe the expected topics for the monitoring teams and the contents for the notes.

## IV. PROCESS

Reclamation will convene and facilitate the SRTTG and the USST to include:

- meeting scheduling and coordination,
- agenda development and distribution,
- coordinate preparation of presentation materials,
- take notes, and
- posting notes and reports (including annual reports) online

Expected Monthly Protocols:

*December through January – Winter Refill*

Reclamation plans to provide monthly updates via e-mail to the SRTTG, outlining current river and reservoir conditions, operations, hydrology, meteorology, and long-range precipitation forecast information. Should any significant issues arise concerning temperature management in this timeframe, an SRTTG meeting will convene, as appropriate. Following dry or critical years, SRTTG meetings will be convened monthly during this period to allow for more proactive planning.

*February through April – Temperature Management Preparation*

- Reclamation will convene SRTTG meetings from February through April on a monthly basis, or more often as necessary to ensure communication and coordination as planning is completed for the temperature management season. Recent droughts and climate change impacts have demonstrated the need to use more conservative modeling assumptions due to lower runoff and more intense heat waves than in the historic record. They also show the need to explore a wider range of release options relative to historic. Additionally, temperature management may need to consider impacts to pre-spawn mortality and hatchery temperature conditions.

<u>February</u>: Reclamation will prepare initial projections of anticipated temperature management capability and considerations in mid-February based on the February hydrologic and runoff forecasts from DWR and National Weather Service River Forecast Center. These initial projections, at minimum, may use Reclamation's historical performance relationships based on total and cold water pool storage. Also, initial projections will use preliminary allocations based on hydrologic forecasts. These projections are also anticipated to be shared with the SRTTG in the third full week of February and represents the initiation of the process for developing temperature management plans for the year, recognizing that the forecasts remain highly uncertain this early in the year.

<u>March</u>: Reclamation will prepare updated projections of anticipated temperature management capability and considerations in mid-March as updated hydrologic forecasts become available, and more often, should sufficient new information warrant. These projections, at minimum, may

use Reclamation's historical performance relationships based on total and cold water pool storage. These updated projections will be shared with the SRTTG in advance of scheduled SRTTG meetings and will assist with on-going development of an initial draft temperature management plan. If conditions indicate projected total Shasta storage on May 1 will be less than 2.5 MAF, then Reclamation will initiate discussions regarding Tier 4 operations and intervention measures.

April: Reclamation will again prepare updated projections of anticipated temperature management capability and considerations as updated hydrologic forecasts become available, and more often should sufficient new information warrant. These initial projections, at minimum, will use available physical modeling tools. These updated projections will be shared with the SRTTG in advance of scheduled SRTTG meetings and serve as the first forecast of the temperature Tier.

If the Tier 1 temperature management approach is infeasible, an approach to evaluating the possibility of Tier 2 and 3 temperature management strategies will occur monthly during the Temperature Management Preparation phase. Preliminary modeling will start with attempting to meet 53.5°F for the duration of the temperature management season. If this is infeasible, then modeling will attempt to meet 56°F for the duration of the season. If modeling supports being able to meet 56°F, then Tier 2 and 3 temperature management scenarios will be considered in an iterative fashion. Tier 2 temperature management scenarios will be iterated through targeting 56°F rather than 53.5°F one additional week at the start and end of the temperature management period until all weeks are targeting 56°F except the week of greatest historical spawning or a week that is more biologically protective (e.g. minimizes temperature dependent mortality), which would target 53.5°F. If no weeks at 53.5°F are feasible, then a Tier 3 scenarios will be iteratively evaluated. Tier 3 scenarios provide for the reduction in the duration and minimum temperature targeted. These scenarios will be similar to the Tier 2 scenarios but target slightly warmer minimum temperatures ranging between 53.5°F and 56°F. The Tier 2 or Tier 3 scenario that minimizes temperature-dependent mortality and is feasible with the TCD will be selected for the TMP.

Reclamation will draft a TMP and submit to SRTTG for review. Reclamation will address the SRTTG comments and submit an Initial TMP to SWRCB for review. If conditions indicate projected total Shasta storage on May 1 will be less than 2.5 MAF, then Reclamation will initiate discussions regarding Tier 4 operations and intervention measures.

*May – Communication of Draft Plan and Transition to Temperature Management*

In early May, Reclamation will determine, based on actual conditions, the Shasta cold water pool volume on May 1. This, in concert with modeling information, will determine an initial Tier. Winter-run Chinook salmon spawner and redd survey data collection by CDFW and USFWS will be communicated to the SRRTG on a weekly basis at the start of these surveys after May 1. Temperature management begins May 15, or when the SRTTG determines, based on real-time operations that winter-run Chinook salmon have spawned, whichever is later. The presence of spawning winter-run Chinook salmon, redd construction or observations from CDFW and USFWS is critical to communicate to the Central Valley Operations (CVO) for coordinating the start of temperature management.

Also in early May, Reclamation anticipates presenting the initial draft temperature management plan to the CVP and SWP water and power contractors, Tribes, non-governmental organizations, and other interested parties and stakeholders during the regularly scheduled Fish and Water Operations Coordination Call during the first full week of May. Based on feedback from that meeting and any other on-going dialog among the SRTTG, Reclamation anticipates submitting a final TMP to SWRCB and NMFS on or about May 20.

*June through October – Active Temperature Management*

Reclamation plans to convene SRTTG meetings each month through October, or more often as warranted by any changing conditions, to ensure tracking and monitoring of the TMP. Temporary exceedances of the daily average temperature criteria of more than 3 consecutive days will be reported to the SRTTG. Should changes to the TMP be necessary, those changes will be developed through communication and coordination with the SRTTG, and other interested parties as warranted.

In October, data collection by CDFW and communication to CVO will be coordinated to determine the ending date of temperature management: October 31, or when the SRTTG determines, based on real-time information, when 95% of winter-run Chinook salmon alevin have emerged, whichever is later.

*November – Fall Transition Temperature Management*

Reclamation plans to operate the TCD in a manner to minimize in-river thermal impacts with remaining cold water pool resources after October 31, if available, until seasonal changes and ambient conditions dominate river cooling downstream.

Data Monitoring Plan:

- Monthly Data collected in accordance with SWRCB 90-5 [add link]
- Near-real-time reporting through Reclamation's information
- Transmittal of pertinent data and information to the SRTTG prior to meetings or more often as conditions warrant, including applicable modeling and tracking information during the course of the temperature management season.
- Monitoring and communication to determine on-set of winter-run-r Chinook salmon spawning
- Monitoring and communication to determine when 95% of winter-run-r Chinook salmon eggs have hatched, and alevin have emerged

## A. Monitoring Teams

### a. Sacramento River Temperature Task Group

Reclamation proposes to convene the SRTTG, consisting of agencies, tribes and SRS contractors having direct interest on cold water pool management on the Sacramento River, at least monthly from February through October. Reclamation will share operational information monthly, and the SRTTG will improve technical dialogue on the implementation of the temperature management plan.

## B. Schedule

A. Mid-March:
   b. Review forecasted Shasta Reservoir total storage
   c. Discuss intervention measures, as appropriate

B. April: after Bulletin 120 and operations forecast completed
   a. First temperature model run
   b. Forecast of temperature tier
   c. Draft TMP to SRTTG for review
   d. Submit Initial TMP to SWRCB for review
   e. Seasonal Shasta refill report

C. May:
   a. Initial determination of tier
   b. Submit Final TMP to SWRCB and NMFS

D. May-October:
   a. Implement/Update and post the TMP to Reclamation's website
   b. Monthly SRTTG meetings

E. December:
   a. Seasonal Report on Shasta Cold Water Pool Management

F. February:
   a. Submit annual report, including total egg-to-fry survival/temperature dependent mortality, and consideration of independent review, if warranted.
   b. Projection of water operations

## C. Updates to Guidance Document

In addition, it is expected that as this guidance is being implemented there will be necessary revisions to the document to provide further clarification and refinement. Reclamation and DWR, with technical assistance from the FWS, NMFS, CDFW, and SWRCB, commit to reviewing this implementation guidance following each water year, at a minimum. to identify and incorporate any necessary revisions.

**BOX 1: SACRAMENTO RIVER TEMPERATURE TASK GROUP AGENDA**

**Date**

**Roster**

Agency, Office, Name, Alternate(s)

**Topics**

1. Introductions
2. Purpose and Objective
3. Hydrology Update
4. Operations Update and Forecasts
    a. Storage/Release Management Conditions
    b. Temperature Management
5. River Fish Monitoring: carcass surveys, redd counts, stranding and dewatering surveys and sampling at rotary screw traps
6. Fish Distribution/Forecasts: Estimated percentage of the population upstream of Red Bluff Diversion Dam for steelhead, winter-run and spring-run Chinook salmon. Livingston Stone National Fish Hatchery Update
7. Seasonal Topics
8. Discussion
9. Review Action Items
10. Next Meeting Scheduling

**Materials**